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INDUCED VERTICAL DISPARITY EFFECTS ON LOCAL AND GLOBAL STEREOPSIS

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ABSTRACT

Although significant amounts of vertical misalignment can have a noticeable effect on visual performance, there is less conclusive evidence about the effect of very small amounts of vertical disparity on quantified stereopsis. Hence, the aim of this study was to investigate the effects of induced vertical disparity on local and global stereopsis at near.

MATERIALS & METHODS

Ninety participants wearing best-corrected refraction had local (Stereofly circles, see figure 4) and global (TNO, see figure 1) stereopsis tested with 0.5 and 1.0 prism diopter (Δ) vertical prism in front of their dominant and non-dominant eye in turn. This was compared to local and global stereopsis in the same subjects without vertical prism. Data were analyzed in SPSS.17 software using the independent samples T and the repeated measures ANOVA tests.

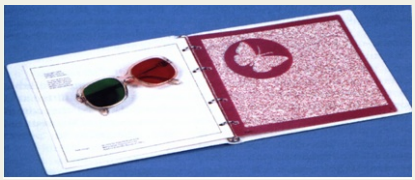

Figure 1: TNO Global Stereo Test

Inclusion criteria are listed below:

1. Best-corrected visual acuity 6/6 or better in each eye at 6 m and 40 cm
2. Absence of a strabismus at 6 m and 40 cm with unilateral cover test
3. Absence of vertical heterophoria with alternate cover test and confirmed with the subjective alternate cover test (Phi test)
4. No vertical fixation disparity with the near Mallett fixation disparity unit
5. Presence of at least a vertical vergence break point of 4$^{\Delta}$ during vertical fusional vergence measurement with a prism bar
6. No history of eye and head trauma
7. Normal eye and ocular health
8. Presence of a motor dominant eye as determined using the Miles test

RESULTS

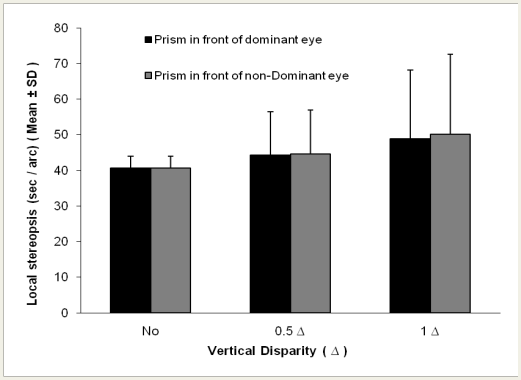

Figure 2: Mean local stereopsis as measured with the Stereofly test. Variation with dominancy and amount of vertical disparity.

Of the 90 participants (mean age ± SD 20.97±1.25), 64 (71.1%) were females and 26 (28.9 %) were males. Repeated measures ANOVA showed differences in the mean stereopsis between the different induced vertical deviations for both local and global types. The Bonferroni test was used for the pairwise comparisons. The pairwise comparisons on the TNO test illustrate that mean stereopsis is not significantly different depending on whether the vertical prism is placed in front of dominant or non-dominant eye ($p > 0.05$). There was a significant difference in the mean stereopsis between before and after inducing vertical disparity with 0.5$^{\Delta}$ or 1$^{\Delta}$ ($p < 0.05$).Local stereopsis thresholds were reduced by 10 seconds of arc or less on average with 1.0$^{\Delta}$ of induced vertical prism in front of either eye (figure 2). However, global stereopsis thresholds were reduced by over 100 seconds of arc by the same 1.0$^{\Delta}$ of induced vertical prism (figure 3).

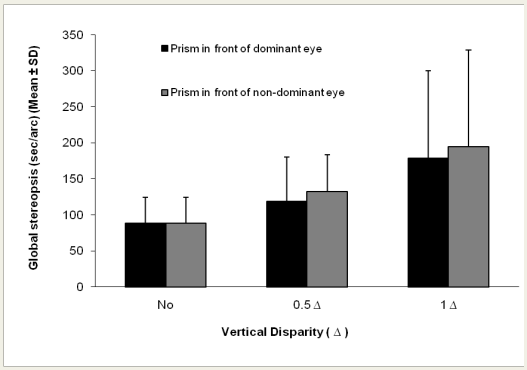

Figure 3: Mean global stereopsis as measured with the TNO test. Variation with dominancy and amount of vertical disparity.

CONCLUSIONS

Induced vertical disparity decreases local and global stereopsis. This reduction is greater when vertical disparity is induced in front of the non-dominant eye, and affects global more than local stereopsis. Induced vertical disparity affects global stereopsis thresholds by an order of magnitude (or a factor of ten) more than local stereopsis. stereopsis (such as the TNO used in this study) is more sensitive to vertical misalignment than a test such as the Stereofly, that measures local stereopsis. See figure 4.

Figure 4: Stereofly local stereo test

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[a] Stereo Optical Co., Inc. 8623 W. Bryn Mawr Ave., Suite 502, Chicago, IL 60631.
[b] Sussex Vision International, A2 Dominion Way, Rustington, West Sussex, BN16 3HQ, United Kingdom.

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